



Eighth Semester B.E. Degree Examination, June/July 2023  
**Pavement Design**

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
 2. Use of relevant IRC charts are permitted.

**Module-1**

- 1 a. What is Frost Action? Explain the causes and remedies of the Frost Action. (10 Marks)
- b. What are the design strategies variables to complete pavement design? Explain them briefly. (10 Marks)

OR

- 2 a. Plate load test was carried out using 30cm diameter plate on subgrade and WBM pavement layer of thickness 45cm which was able to sustain a load of 600kg and 3800kg respectively at a deflection of 0.5cm. If the wheel load of 5100kg with a contact pressure of 7kg/cm<sup>2</sup> is applied then determine
  - i) Maximum deflection on the pavement
  - ii) If maximum deflection was 0.35cm what would be the pavement thickness
 [Refer Fig.Q2(a)]

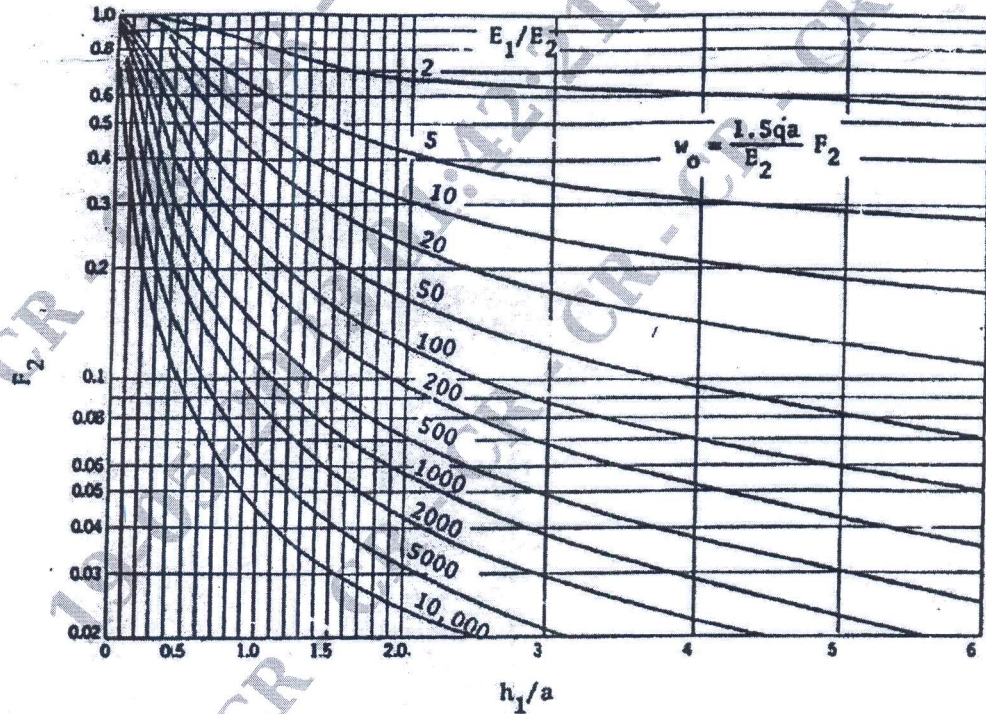


Fig.Q2(a)

(08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Determine the maximum vertical stress under a wheel would be the pavement thickness a contact pressure of  $5 \text{ kg/cm}^2$  applied at the surface of pavement.
- Plot the vertical stress distribution diagram at a depth of  $3a$  and upto a radial distance of  $4a$ .
  - Plot the vertical stress distribution diagram at  $r/a = 1$  and upto a depth of  $5a$ .
- [Refer Fig.Q2(b)]

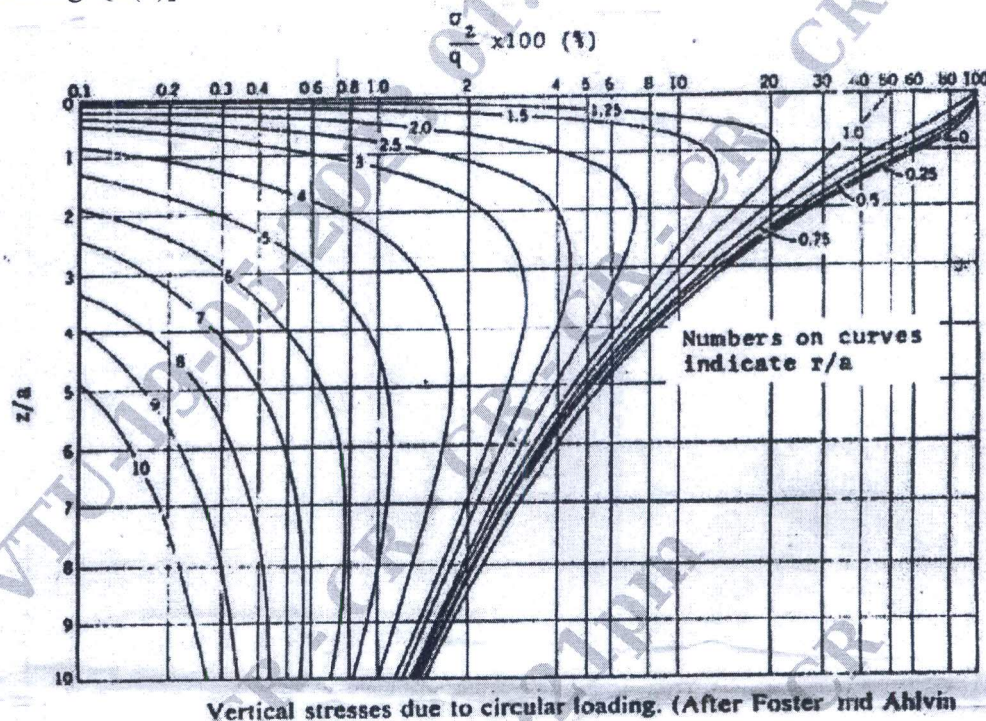


Fig.Q2(b)

(12 Marks)

### Module-2

- 3 a. What is contact pressure? Explain the relation between design wheel load and contact pressure with a neat diagram. (10 Marks)
- b. Calculate the design repetitions for 20 years period for various wheel loads equivalent to 2268kg wheel load using the following data on 4 lane road. The average daily traffic in both distance was 215.

Wheel load (kg)	2268	2722	3175	3629	4082	4536
% of total traffic volume	13.17	15.30	11.76	14.11	6.21	5.84

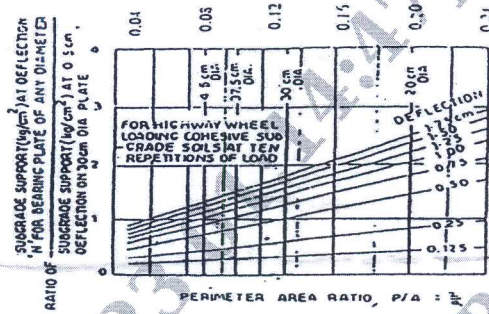
(10 Marks)

OR

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- 4 a. What are the factors affecting pavement design? Explain them briefly. (10 Marks)
- b. Design a highway pavement for wheel load of 4100kg. With a tyre pressure of  $5 \text{ kg/cm}^2$  by McLeod method. The plate bearing test carried out on a subgrade soil using 30cm diameter plate yield pressure of  $2.5 \text{ kg/cm}^2$  after 10 repetitions of load at 0.5m deflection. [Refer chart Fig.Q4(b)]. (10 Marks)



Relationship of Subgrade Support with P/A ratio

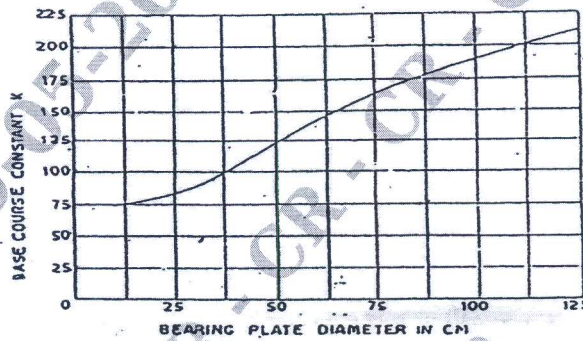


Figure 4.4: Relation between Plate Diameter and Base Course Constant

Fig.Q4(b)

**Module-3**

- 5 a. What are the causes of failures in flexible pavement? Explain them briefly. (10 Marks)
- b. What is rutting in flexible pavement? Explain the mechanisms of rutting with a neat sketch. (10 Marks)

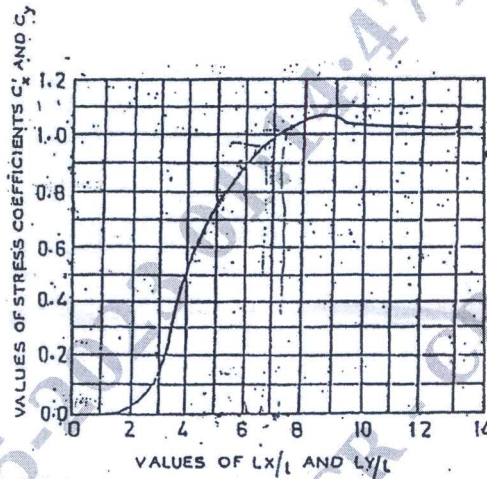
OR

- 6 a. What are the deteriorations in flexible pavement due to functional failure? Explain them briefly. (10 Marks)
- b. Explain Benkelman beam deflection method for structural evaluation of flexible pavement and subsequent determination of overlay thickness. (10 Marks)

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**Module-4**

- 7 a. The CC slab of thickness 20 cm is constructed over a granular subbase having,  $k = 15 \text{ kg/cm}^2$ . Maximum temperature difference between top and bottom of the slab during summer midday and night was found to be  $18^\circ\text{C}$ . The spacing between the transverse joint is 4.5m and the spacing between the longitudinal joint is 3.5m. The design wheel load = 5000kg. Radius of loaded area = 15cm,  $E = 3 \times 10^5 \text{ kg/cm}^2$ ,  $\mu = 0.15$ ,  $\alpha \text{ or } e = 10 \times 10^{-6}/^\circ\text{C}$ ,  $F = 1.5$ . Using the charts find out the worst combination of stresses and justify your answer [Refer Fig.Q7(a)].



(c) WARPING STRESS COEFFICIENTS.  
(BRADBURY'S)

Fig.Q7(a)

(12 Marks)

- b. Define the following in the context of cement concrete pavement:
- Different regions of loading with neat sketch
  - Concept of warping with neat sketch
  - Radius of relative stiffness with equation
  - Radius of resisting section with equation

(08 Marks)

OR

- 8 a. What are the factors affecting the design of rigid pavement explain them briefly. (10 Marks)
- b. The design thickness of a pavement is 26cm considering a design axle load of 12000kg on single axle and M-40 concrete with characteristics compressive strength of  $400 \text{ kg/cm}^2$ . The radius of relative stiffness is found to be 62.2cm. If the elastic modulus of dowel bar steel is  $2 \times 10^6 \text{ kg/cm}^2$  modulus of dowel concrete interaction is  $41,500 \text{ kg/cm}^3$ . Joint width is 1.8cm. Design the dowel bars for 40% load transfer considering edge footing. (10 Marks)

**Module-5**

- 9 a. What are the various types of rigid pavement failure explain with neat sketches? (10 Marks)
- b. Explain the functional evaluation of cement concrete pavement by visual inspection and unevenness measurements. (10 Marks)

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OR

- 10 a. What are joints? Explain the functions and requirements of joints. (08 Marks)
- b. What are the different types of joints and explain them briefly with neat sketches. (12 Marks)

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